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PTEROMALUS ELEVATUS (WALKER) (HYMENOPTERA: PTEROMALIDAE): NORTH AMERICAN RECORDS OF AN IMMIGRANT PARASITOID OF THE GALL FLY *UROPHORA JACEANA* (DIPTERA: TEPHRITIDAE)

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Abstract.—*Pteromalus elevatus* (Walker), a Palearctic species, is reported from several localities in Nova Scotia as a probable parasitoid of the gall-inducing tephritid *Urophora jaceana* (Hering) on black knapweed (*Centaurea nigra*). These records are only the third for *P. elevatus* in the New World; the first such record (Newfoundland), published in the European literature, has been overlooked by North American workers, and a collection of specimens in New Brunswick has been briefly noted in the American literature. This species is described and its distribution and habits in the Old World are summarized.

Key Words: Insecta, Pteromalidae, parasitism, adventive insects, biological control, Tephritidae

As part of continuing surveys for immigrant insects in the Canadian Maritime Provinces, we report here the collection of *Pteromalus elevatus* (Walker) (Hymenoptera: Pteromalidae), a species widely distributed in the western part of the Palearctic region and a known parasitoid of the knapweed gall fly *Urophora jaceana* (Hering) (Diptera: Tephritidae). During the summers of 1993–1995, this pteromalid was taken at numerous sites in Nova Scotia by sweeping flowerheads of black knapweed (*Centaurea nigra* L.). This plant is a principal host of *U. jaceana,* also native to central and western Europe and accidentally introduced into eastern Canada (Foote et al. 1993).

Although a North American record (Newfoundland) for *P. elevatus* was published by Graham (1969) in his monograph of the Pteromalidae of Northwestern Europe, it was inadvertently omitted from the list of pteromalids in the Catalog of Hymenoptera in America North of Mexico (Burks 1979). In addition, Peschken et al. (1982) reported that 3% of 580 *U. cardui* (L.) larvae from galls on Canada thistle (*Cirsium arvense* (L.) Scop.) at Sussex Corner, New Brunswick, were parasitized by this pteromalid (as *Habrocytus elevatus*). The two literature records and our own collection records for *P. elevatus* in Nova Scotia are listed and mapped, together with a short description of the parasitoid and information on its geographic distribution, hosts, natural history, and possible mode of introduction.

Pteromalus elevatus (Walker)

Eutelus elevatus Walker 1834: 366.

Pteromalus elevatus: Walker 1848: 77, Bouček and Graham 1978a: 228, 1978b: 81.

Habrocytus elevatus: Kurdjumov 1913: 13, Bouček 1965: 8, Graham 1969: 538.

A complete synonymy for this species can be found in Graham (1969: 538–539), and Bouček and Graham (1978a: 81).

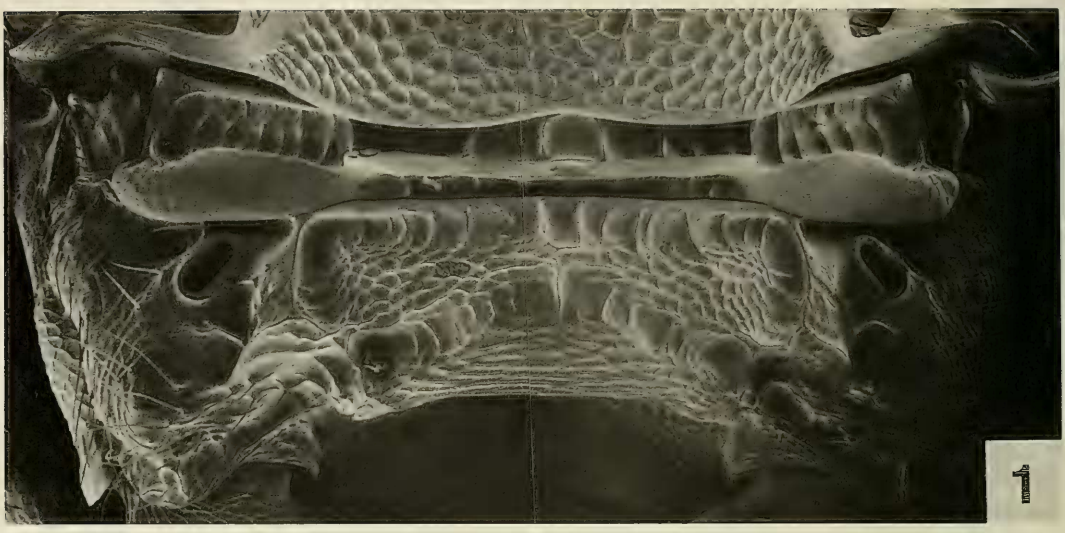


Fig. 1. *Pteromalus elevatus,* composite scanning electron photomicrograph. Propodeum, 65×.

The large and diverse genus *Pteromalus* Swederus (including *Habrocytus* Thomson, see Bouček and Graham 1978a) contains about 100 species in the western Palearctic region (Bouček and Rasplus 1993), and another 40 species in the Nearctic region (Burks 1979). *Pteromalus elevatus* is a member of the *albipennis* group, which includes about 30 Palearctic species (*sensu* Graham 1969).

The female of *P. elevatus,* which is illustrated by Varley (1947: 165) and Redfern (1983: Pl. 7, Fig. 2), can be readily distinguished from those of native Nearctic species of the genus by the combination of its larger body size (2.5–5.5 mm), its host preferences (gall-forming tephritids in flowerheads of composites), and its unique propodeal structure (Fig. 1).

Females (Fig. 2) (and males) of this adventive species are characterized as follows: Head, thorax, and abdomen dark metallic green; coxae and all, except apices of, femora metallic green; tibiae and apices of femora brown, tibiae centrally infuscate; tarsi yellowish, last segment dark brown. Anterior margin of clypeus at most moderately deeply emarginate. Antenna with combined length of pedicellus and flagellum slightly less than width of head; proximal segments of funicle quadrate, the first usually at least very slightly shorter than pedicellus; scape reaching at most to level of lower edge of median ocellus. Head hardly wider than mesonotum. Scutellum discally finely to very finely reticulate. Forewing with row of hairs on lower surface of costal cell complete; postmarginal vein of forewing as long as or slightly longer than marginal vein. Propodeum (Fig. 1) without a costula; panels of median area quite strongly sculptured, for the most part very finely reticulate; median carina raised to form a tooth subbasally. Gaster 1.1–1.6 times as long as head plus thorax; at least 2.5 times as long as broad.

Distribution.—In the Palearctic region, *P. elevatus* is widely distributed throughout most of western Europe, including Great Britain, Sweden, Czechoslovakia, and portions of the former Soviet Union (Moldavia) (Graham 1969).

In North America (Map 1), *P. elevatus* is currently known only from the following localities in New Brunswick (from a North American literature record), Newfoundland (from a European literature record), and Nova Scotia (from our own collecting):

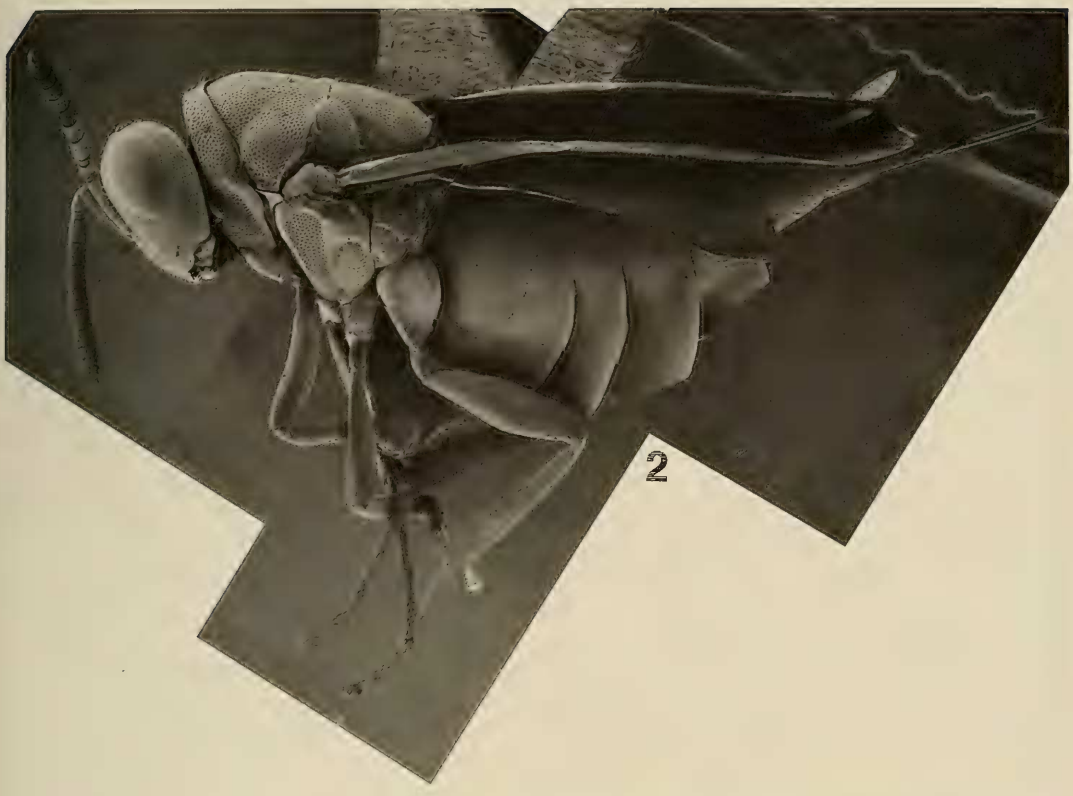
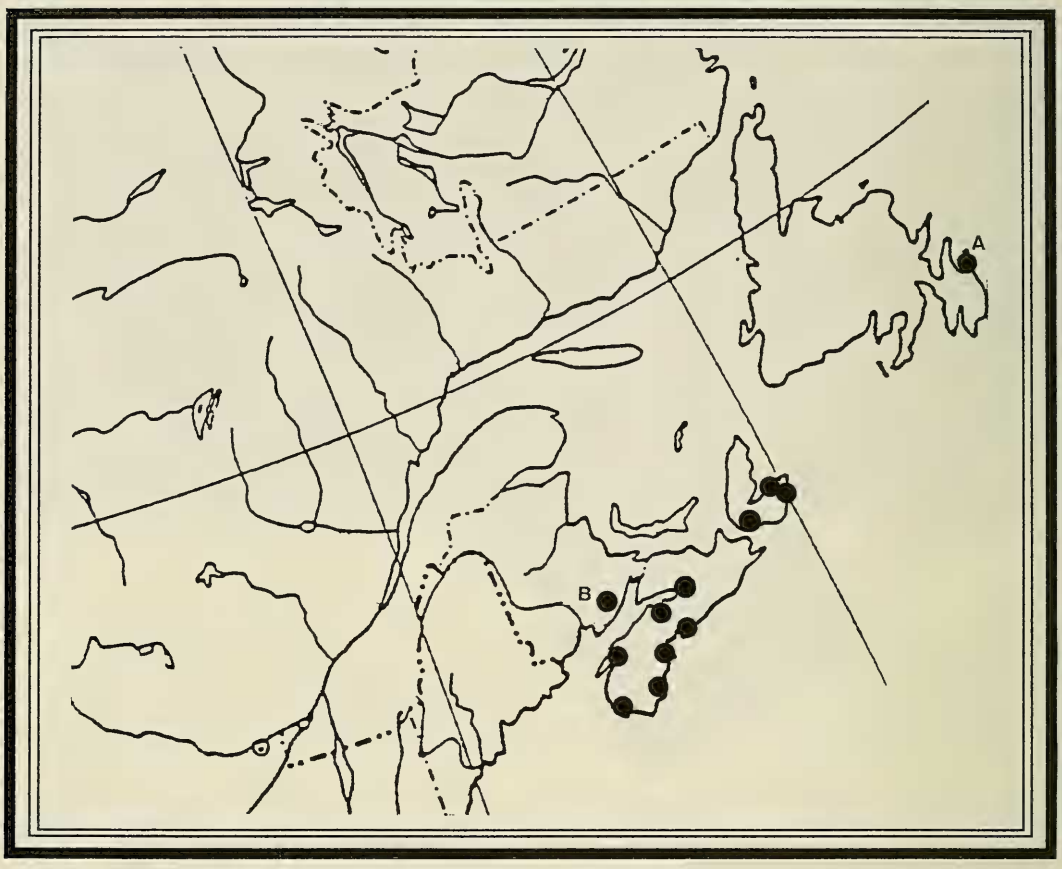


Fig. 2. *Pteromalus elevatus,* composite scanning electron photomicrograph. Female habitus, lateral aspect, 35×.

New Brunswick: "Sussex Corner, IV-1979, ex *Urophora cardui* galls on Canada thistle shoots" (see Peschken et al. 1982: 353). **Newfoundland:** "St. John's, 12-V-1958, R. F. Morris, ex knapweed seed pod" (see Graham 1969: 540). **Nova Scotia:** *Cape Breton Co.,* Cape Breton Isl., Louisbourg, 24-VII-1995; North Sydney, 24-VII-1995; Sydney, 23-VII-1995. *Colchester Co.,* Truro, 22-VII-1995. *Digby Co.,* Digby, 20-VII-1994. *Halifax Co.,* Halifax, 26-VI-1993, 20-21-VII-1995. *Inverness Co.,* Cape Breton Isl., Port Hawkesbury, 23-VII-1995. *Kings Co.,* Kentville, 21-VII-1994. *Lunenburg Co.,* Lunenburg, 19-VII-1994, 21-VII-1995. *Shelburne Co.,* Shelburne, nr. marine terminal, 19-VII-1994. *Yarmouth Co.,* Yarmouth, 20-VII-1994.

Specimens that served as the basis for the Newfoundland and New Brunswick literature records are deposited in the Canadian National Collection of Insects (CNCI, Ottawa). All Nova Scotian specimens were collected or observed by the authors on flowerheads of black knapweed (*Centaurea nigra*); voucher specimens are deposited in the Cornell University Insect Collection (CUIC, Ithaca, NY) and the U.S. National Museum of Natural History (USNM, Washington, DC).

Hosts and natural history.—In western Europe, *P. elevatus* is a parasitoid of seedhead tephritids on certain Asteraceae (= Compositae). Its natural history has been studied by Varley (1947) in Great Britain (as *Habrocytus trypetae* Thomson), who recorded it as an ectoparasitoid of *Urophora jaceana* in galled florets of black knapweed (cited as *Centaurea nemoralis* Jord.), and by Redfern (1983), also in the British Isles,



Map 1. Known distribution of *Pteromalus elevatus* in eastern North America. A, literature record from Graham (1969: 540); B, literature record from Peschken et al. (1982: 353); all other records from authors' collecting.

who recorded it as one of two common ectoparasitoids of *U. stylata* in galled shoots of bull (= spear) thistle (*Cirsium vulgare* (Savi) Tenore).

Eggs are laid in gall cells containing larvae and pupae of the gall fly, or in gall cells already containing other parasitoids. Numerous eggs may be laid on a single host, but usually only one larva matures because newly emerging larvae destroy any other eggs or larvae they encounter. The parasitoid is not host specific and may attack larvae of the eurytomid *Eurytoma curta* Walker and other parasitoids. Depending on climatic conditions, 2–3 generations are produced annually. *Pteromalus elevatus* typically emerges in May and August, and is able to locate numerous gall fly larvae at a stage suitable for parasitism. Newly emerged sexually immature females first feed on the host without laying eggs. The ovipositor is pushed down through the neck of the flask-shaped gall until it stabs a host, which is stung and paralyzed. A secretion hardens around the ovipositor to form a tube through which the hemolymph of the host exudes; the female parasitoid then feeds on the hemolymph. Females generally do not attack the nongall-forming tephritids in knapweed. Adults are found in the field from May until August or occasionally September.

Pteromalus elevatus has also been recorded as a parasitoid of the tephritid gall

flies *Terellia serratulae* (L.), *Urophora cardui* (L.), *U. stylata* (F.), *Noeeta pupillata* (Fallén), and the tortricid moth *Sparganothis pilleriana* Schiffermüller. This parasitoid has been reared from flowerheads of species in the composite genera *Centaurea, Carduus, Cirsium, Arctium,* and *Hieracium.* Because of the difficulty in accurately identifying species of *Pteromalus,* some of these rearing records are probably doubtful (Varley 1947, Peschken et al. 1982, Redfern 1983).

Mode of introduction.—North American populations of *P. elevatus* may have originated from the accidental introduction of the gall fly *U. jaceana,* one of its principal hosts, or with the intentional releases of *U. cardui* in eastern Canada. Larvae of *U. jaceana* live in the flowerheads of black knapweed (*C. nigra*), a species also introduced from Europe and now widespread in the Maritime provinces, the Gaspé, Ontario, British Columbia, and the eastern United States. No doubt the gall fly was accidentally introduced with its host plant; it was first collected in North America in 1923 at Kentville, Nova Scotia, and in 1949 at St. John's, Newfoundland (Shewell 1961).

Possible effects on *Urophora* spp. introduced for biological control.—*Urophora affinis* (Frauenfeld) and *U. quadrifasciata* (Meigen), introduced into the Pacific Northwest for the biological control of pestiferous knapweeds (*Centaurea* spp.), have been able to attain higher densities than in Europe partly because they lack parasitoid enemies in North America (Myers and Harris 1980). These *Urophora* spp., as well as *U. sirunaseva* Hering, which was introduced into the western United States to control yellow starthistle (*C. solstitialis* L.) (Turner et al. 1994), are not known hosts of *P. elevatus.* Thus, even if this parasitoid should become established in areas occupied by *Urophora* spp. imported for knapweed control, there appears to be little risk of adverse effects on tephritid populations. Moreover, these seedhead flies, by themselves, have not reduced densities of target knapweeds in western North America (e.g. Harris and Cranston 1979, Harris 1980). As a natural enemy of the unintentionally introduced *U. jaceana, P. elevatus* poses little or no threat to biological control of weed projects in North America except for possible minor effects on *U. cardui,* a tephritid that has placed little stress on populations of Canada thistle (Peschken et al. 1982).

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